DOCUMENT RESUME

ED 467 793 IR 021 427

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TITLE	Usage of Instructional Materials in High Schools: Analyses of NELS Data.
PUB DATE	2002-04-03
NOTE	13p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 1-5, 2002).
PUB TYPE	Numerical/Quantitative Data (110) -- Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Comparative Analysis; *Computer Uses in Education; Data Analysis; *Educational Technology; High Schools; *Instructional Materials; *School Surveys; Statistical Analysis
IDENTIFIERS	*National Education Longitudinal Study 1988

ABSTRACT

Based on the recommendations of previous research, this study discusses and analyzes the usage of technology and instructional materials in a broad level in the United States. The National Education Longitudinal Study: 1988-96 (NELS88) is a longitudinal study of the 1988 eighth graders by the National Center for Education Statistics (NCES). The same students from the 1988 grade sample have been followed up on every two years. Each student and his/her two teachers responded to the surveys designed by the NCES. The study presented in this paper used the first follow-up (tenth grade) student and teacher data files, and selected 53 items as independent and dependent variables. A total of 15,667 tenth grade students were selected from the first follow-up of NELS88 with their 22,646 teachers (8,572 reading, 4,075 history, 4,023 math, and 5,976 science teachers). All students and teachers who had available variables and achievement scores were included, and the student sample represented all tenth grade students throughout the United States by using weighting method. Results are discussed in terms of the frequency of teachers using instructional materials; comparison of teachers' usage of instructional materials by gender, teaching area, and ethnicity; teachers' academic degree, teaching experience and usage of instructional materials; and uses of instructional materials and student achievement. Seven tables and three figures present findings. (AEF)

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Analyses of NELS Data

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April 3, 2002

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Usage of Instructional Materials in High Schools
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Backgrounds

Technology changes at ever increasing speed. It is necessary for teachers to discover ever more creative and effective instructional materials and technology in classrooms. The Utah Education Network provided video-based learning programs to the high schools, which gave teachers and students access to the high level of education opportunity (US West and Utah Education Network, 1999). Effective instructional materials used in K-12 classes provided the basis for what students can learn and what teachers should teach (Singer & Tuomi, 1999). Using videotape in learning processes, students scored significantly higher on performance than did students in non-video tape groups (Linklater, 1997). Selection and usage of instructional materials were critical for successful teaching. The document of National Science Foundation revealed that too few materials incorporate significant and appropriate use of instructional technology (NSF, 1997). A survey (Welty & Tsai, 1995) found that use of student-oriented materials increased, but use of teacher-oriented instructional materials decreased. Hay (1997) used captioned video scripts at fourth grade students with different reading levels. Students favored it, but teachers' reactions varied according to objectives. The report of Jones and Compton (1998) emphasized schools to enhance the teaching and learning of advanced technology and instructional materials as new learning area, and researchers worked with teachers to introduce technology and instructional materials into the classrooms.

The usage of technology and instructional materials promotes teaching and learning effects. Knowing how much teachers understand about technology and instructional materials and how they use these technology and materials in classrooms are essential for staff-

development programs. Determining teachers' knowledge and usage levels of technology and instructional materials in the classrooms will help planners deliver effective in-service education programs. This knowledge can increase the likelihood that technology and materials resources will lead to success (Atkins & Vasu, 1998).

Numbers of articles indicated importance and effectiveness for usage of instructional materials and teachers' key roles for appropriate using these materials and technology in practice. However, few studies discussed teachers' usage of instructional materials in a nationwide level. Data and results from a large and sophisticated national database are more universal than data collected by individual researchers. Using a large national database, such as National Education Longitudinal Study: 1988-96 (NELS88), the results could be generalized and applied to a broader level. Based on the recommendations of previous research, this study discusses and analyzes the usage of technology and instructional materials to a broad level in the United States.

Methods

Data Sources and Student Sample

NELS88 is a longitudinal study of the 1988 eighth graders by the National Center for Education Statistics (NCES). The same students from the 1988 grade sample have been followed up every two years. Each student and his/her two teachers responded to the surveys designed by the NCES.

The current study used the first follow-up (tenth grade) student and teacher data files, and selected 53 items as independent and dependent variables. A total of 15,667 tenth grade students were selected from the first-follow-up of NELS88 with their 22,646 teachers (8,572 reading,

4,075 history, 4,023 math, and 5,976 science teachers). All students and teachers who had available variables and achievement scores were included, and the student sample represented all tenth grade students throughout the United States by using weighting method.

Data Analyses

A descriptive statistics was used to indicate the central trends of all teachers' usage of instructional materials. A three-way ANOVA was used to compare teachers' usage of the materials by gender, subject area, and ethnicity. A Spearman correlation was used to reveal the relationships between teachers' academic degree, teaching experience and usage of the materials. A multiple linear regression was used to get the effects of teachers' usage of instructional materials on student's achievement.

Results

Central Trends

About 93.6% high school teacher's primary and secondary teaching resource is textbooks. Near 50% teachers often use audio-visual and other reading materials, and 31.6% teachers use other instructional materials sometimes. However, about 50% of the teachers rarely use and 25% teachers never use films in the classes.

Table 1. The frequency of teachers using instructional materials

	Textbooks	Other reading materials	Audio-visual materials	Other instructional materials	Film
N	12,228	11,959	11,971	9,051	11,885
Mean	3.73	2.56	2.53	2.33	1.75
SD	0.62	0.84	0.73	0.87	0.60

Frequency range is 1-4.

Comparison of Teachers' Usage of Instructional Materials

Teachers in different gender. Generally, results did not show a significant difference between male and female teachers' usage of textbooks, audio-visual materials, and other instructional materials (ANOVA: $F_{[1]}s = 0.4 - 128$, and $p_{[1]}s = .001 - .522$), although the male teachers use films slightly more often than the female teachers, and the female teachers like to use other reading and other instructional materials more often.

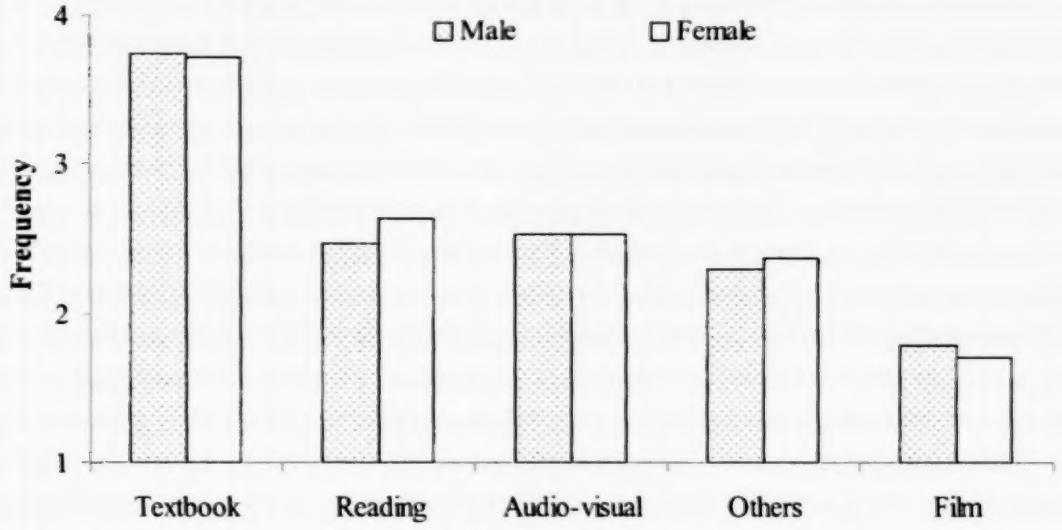

Figure 1. Comparison of teacher's using instructional materials by gender

Teachers in different subjects. Figure 2 shows that the most obvious factor is the differences between math teachers and other subject teachers. Math teachers use more textbooks but significantly less use reading, audio-visual and other instructional materials than other subject teachers, and they almost never use films in the classes. Reading teachers also less use textbooks and other instructional materials, except using other reading materials. The results reveal that there are significant differences between different subject high school teachers' using instructional materials (ANOVA: $F_{[3]}s = 125 - 2067$, and all $p_{[3]}s < .001$).

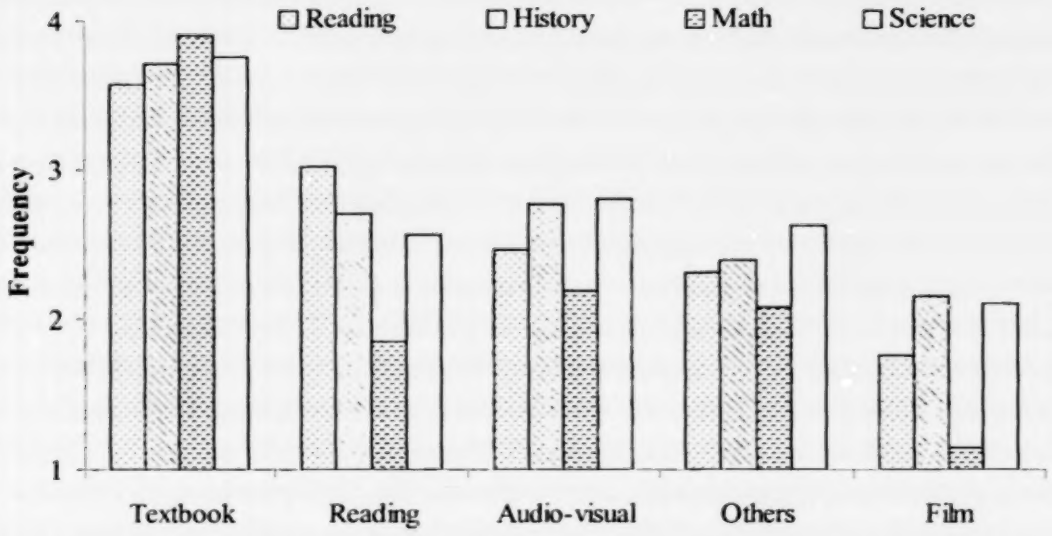

Figure 2. Comparison of teacher's using instructional materials by teaching subject area

Teachers in different ethnicity. Different ethnical high school teachers using textbooks, audio-visual materials and films are at similar levels, but the Hispanic and Black teachers use more other reading ($F_{[3]} = 20$, $p_{[3]} < .001$) and other instructional materials ($F_{[3]} = 8$, $p_{[3]} < .001$) than White and Other minority teachers do.

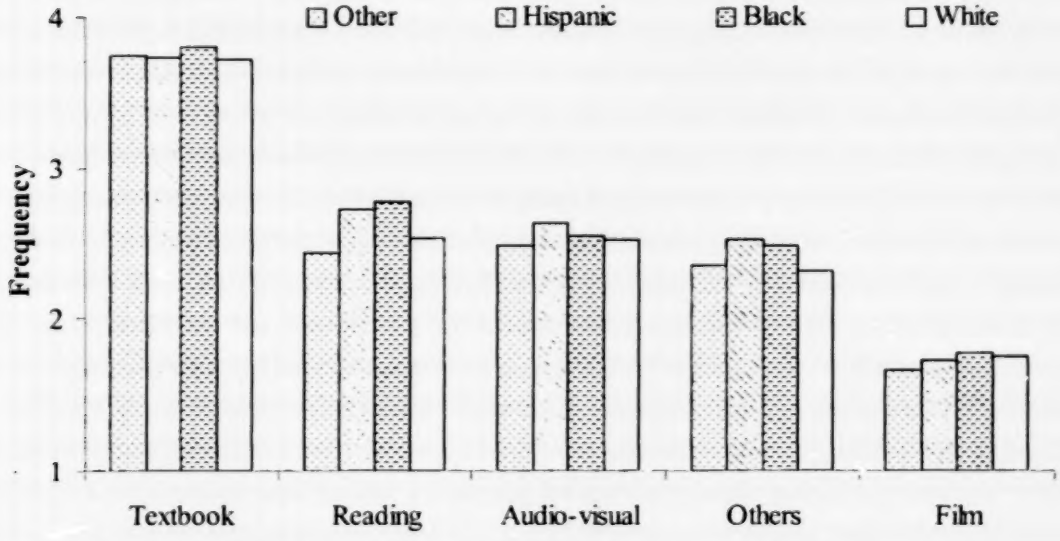

Figure 3. Comparison of teacher's using instructional materials by ethnicity

Interaction analysis. Most results of interaction also have significant differences ($F_{[9]}$s = 2.45 -- 4.85, $p_{[9]}$s = .001 -- .009). The comparisons showed that Hispanic and Black science and history teachers using audio-visual materials most, but all math teachers rarely used audio-visual materials. Male Hispanic and other minority female science teachers used other instruction materials most.

Table 2. Comparison of teacher's using instructional materials by gender, ethnicity, and teaching subject area (Means)

		Male					Female				
		Text book	Reading	Audio-visual	Others	Film	Text book	Reading	Audio-visual	Others	Film
Other	**Reading**	2.80	3.40	2.00	3.00	1.24	3.74	3.00	2.68	2.72	1.93
	History	3.43	2.43	2.86	2.80	2.54	3.50	1.78	1.72	2.77	1.57
	Math	4.00	1.88	2.08	1.78	1.05	3.86	1.93	2.42	2.40	1.21
	Science	3.90	2.80	2.60	1.67	1.60	3.92	2.27	2.82	3.17	2.00
Hispanic	**Reading**	3.73	3.00	2.47	2.44	1.76	3.48	3.30	2.56	2.87	1.67
	History	3.92	2.88	2.96	1.81	2.23	3.00	2.83	2.67	2.80	2.00
	Math	3.75	2.14	2.09	2.14	1.25	4.00	1.38	2.38	2.17	1.17
	Science	3.73	3.08	3.18	3.24	2.17	3.72	2.84	2.89	2.76	1.95
Black	**Reading**	3.56	3.44	2.80	3.17	2.01	3.60	2.91	2.51	2.46	1.84
	History	3.96	2.93	2.85	2.86	1.91	3.90	2.85	2.45	2.31	1.70
	Math	3.75	2.35	2.15	2.28	1.51	3.92	2.29	2.38	2.36	1.22
	Science	3.83	2.82	3.00	2.71	2.32	3.99	2.94	2.90	2.93	2.17
White	**Reading**	3.56	3.01	2.44	2.28	1.80	3.59	3.01	2.47	2.34	1.75
	History	3.72	2.64	2.74	2.43	2.15	3.75	2.79	2.82	2.38	2.16
	Math	3.92	1.75	2.14	2.05	1.13	3.89	1.93	2.23	2.11	1.13
	Science	3.75	2.55	2.75	2.54	2.13	3.75	2.58	2.85	2.84	2.08

Teachers' Academic Degree, Teaching Experience and Usage of Instructional Materials

The results of Pearson correlation revealed that both correlation coefficients between teachers' academic degree and usage of audio-visual material (r=.05, p=.00) and other

instructional materials (r=.03, p=.02) were significantly positive. Teachers' experience (years of teaching) was also positively correlated with usage of the materials (r=.07, p=.00 / r=.01, p=.30).

Table 3. Pearson correlation between teachers academic degree, teaching years, and usage of instructional materials

		Textbook	Reading	Audio-visual	Others	Film
Degree	r	-0.009	0.051	0.047	0.024	0.044
	p	0.317	0.000	0.000	0.023	0.000
	N	11,890	11,624	11,642	8,819	11,590
Teaching Years	r	0.055	0.017	0.074	-0.008	0.033
	p	0.000	0.059	0.000	0.463	0.000
	N	11,981	11,719	11,732	8,886	11,679

Usage of Instructional Materials and Student Achievement

From the multiple linear regression, teachers' usage of films, audio-visual and other instructional materials did not show significant correlation with students' reading, history and science achievement. However, math teachers' usage of audio-visual materials (Beta=.08, p=.00) and calculators (Beta=.141, p=.00) had significantly positive correlation with math achievement. Science teachers' usage of experiments and science achievement had a very significant correlation (Beta=.139, p=.00).

Table 4 a. Multiple linear regression for student reading achievement by teacher's usage of instructional materials

Reading	B	SE	Beta	t	p
(Constant)	48.93	1.91		25.67	0.000
Textbook	-0.21	0.29	-0.02	-0.74	0.462
Reading	1.82	0.33	0.12	5.58	0.000
Audio-visual	-0.37	0.38	-0.02	-0.97	0.330
Others	-0.53	0.25	-0.04	-2.11	0.035
Film	-0.23	0.55	-0.01	-0.41	0.682

R Square = 0.01

Table 4 b. Multiple linear regression for student history achievement by teacher's usage of instructional materials

History	B	SE	Beta	t	p
(Constant)	40.36	2.84		14.19	0.000
Textbook	1.00	0.48	0.06	2.08	0.038
Reading	2.16	0.44	0.15	4.93	0.000
Audio-visual	0.29	0.58	0.02	0.50	0.618
Others	0.31	0.38	0.02	0.82	0.415
Film	0.19	0.67	0.01	0.29	0.772

R Square = 0.02

Table 4 c. Multiple linear regression for student mathematics achievement by teacher's usage of instructional materials

Math	B	SE	Beta	t	p
(Constant)	41.61	3.19		13.04	0.000
Textbook	3.48	0.69	0.14	5.04	0.000
Reading	-0.94	0.34	-0.07	-2.78	0.006
Audio-visual	0.91	0.31	0.08	2.96	0.003
Others	-0.91	0.31	-0.08	-2.90	0.004
Film	-2.09	0.86	-0.06	-2.42	0.016

R Square = 0.04

Table 4 d. Multiple linear regression for student science achievement by teacher's usage of instructional materials

Science	B	SE	Beta	t	p
(Constant)	55.25	2.21		24.98	0.000
Textbook	-0.67	0.44	-0.04	-1.52	0.129
Reading	-0.04	0.35	0.00	-0.11	0.914
Audio-visual	-0.21	0.41	-0.01	-0.51	0.613
Others	0.14	0.29	0.01	0.49	0.622
Film	-0.69	0.48	-0.04	-1.44	0.151

R Square = 0.00

Discussions and Conclusions

There are some important findings in this study, which will be valuable for high school teachers' usage of instructional materials.

In the nationwide study, high school teachers use instructional materials at a low level. They did not use instructional materials as one of the main resources in teaching procedures. Compared to using textbooks, teachers used these instructional materials with less frequency in the classrooms. This trend does not meet the requirements of current new and rapidly developing educational technology and instructional materials.

The effectiveness of teachers' usage of the instructional materials is not notable. From the results of the regression, the usage of instructional materials did not show significant effects on students' reading, history and science achievement. The usage of some materials even had negative relationships with students' achievement. How to use these instructional materials effectively and how teachers can quickly master the features, methods, and roles of instructional materials in teaching procedures are future topics for educational technology and teacher training researchers.

Usage of films and computers is reasonably backward in high school classrooms. In average, a teacher used films 1-3 times per semester only. Compared with chalk and board, films could be kept, revised, and repeatedly used, and by copying method, it could contain information and figures extracted from books, magazines, computers, and Internet. Usage of computers also may obtain vast amount information from educational software and Internet. Both of them will become the most important and effective instructional materials in the future.

A person's background needs to be considered for educators. Except for gender, teachers' ethnicity, teaching subjects, academic degree, and teaching experience have significant

relationships with usage of instructional materials. These results provide information for teachers' usage of instructional materials training programs.

Teacher educators, principals, and policy-makers in states and districts need to encourage teachers, especially math teachers, new teachers, White and other minority teachers, to use new and effective instructional materials. Educational technology and instructional material researchers and developers need to investigate teachers' needs and difficulties, summarize practical experiences, and develop more effective, practical, and easier learning and using instructional materials. It is also very important to introduce and spread effective and operative instructional materials and equipment, and train high school teachers to use these instructional materials in the classrooms. When teachers use instructional materials more often and effectively, student achievement will be improved significantly.

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Corporate Source: Session 29.07
The annual meeting of the American Educational Research Association, 2002

Publication Date: 4/3/2002

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